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Screening for - and prevalence of - anxiety and depression in cardiac rehabilitation in the post-COVID era. An observational study

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ABSTRACT

Background: Approximately 20–30% of patients with a cardiac disease suffer from anxiety and/or depression, leading to poor health outcomes. To identify this subgroup, clinical guidelines recommend screening for anxiety and depression in cardiac rehabilitation (CR). It is unknown how screening practice is delivered post-COVID.
Methods: This observational study used data from the National Audit of Cardiac Rehabilitation from April 2018–March 2022. Descriptive statistics were used to assess screening rates and prevalence, while a multivariate logistic regression model was performed to analyse determinants for screening for anxiety and depression among patients participating in cardiac rehabilitation.
Results: The population consisted of 245,705 patients, where 128,643 (52.4%) were screened and 117,062 (47.6%) were not. Patients attending CR during first year of COVID-19 were less likely to be screened. Patients with female gender, living alone, non-white ethnicity, living in the most deprived areas, current smoking, and physical inactivity were less likely to be screened, while patients who were revascularized, having an objective physical fitness test, and attending a certified CR center were more likely to be screened. For patients attending CR during COVID-19, the prevalence of anxiety and depression decreased significantly. For anxiety the prevalence dropped from 34.4% to 15.8%, for depression the prevalence dropped from 33.5% to 16.5%.
Conclusion: CR service provision was negatively impacted during COVID-19, leading to much lower screening for anxiety and depression in the CR setting. Prevalence of anxiety and depression decreased during COVID-19 for this population, possibly because psychologically affected patients refrained from attending CR.

1. Introduction

It is well-established that 20–30% of patients with a cardiac disease suffer from anxiety and/or depression [1–3]. As anxiety and depression in cardiac patients are associated with reduced quality of life and increased morbidity and mortality, these conditions add a substantial burden on both society as well as the individual patient [1,4,5]. A recent ESC CVD consensus statement states that it is important to identify and treat patients for anxiety and depression concurrently with their cardiac disease [6].

Cardiac rehabilitation (CR) is an evidence-based multi-component intervention, and clinical guidelines recommend screening for anxiety and depression as a core component of CR [7,8]. Despite these recommendations, the literature reveals a gap between guidelines and clinical practice, indicating an unsystematic approach to screening practice in routine CR [3,9–11].

Following the COVID-19 outbreak in March 2020, the delivery of CR was impacted globally [12,13]. On the provider level, the impact was caused by e.g., quarantine, deployment of staff, and the need for development of digital solutions due to not being able to conduct in-person CR [12,14]. This impact led to reduced or ceased CR delivery and in some cases transition to digital solutions such as CR delivery through telephone, emails, or videocalls [12]. In a study of CR delivery during COVID-19 across 70 countries (n = 1062 CR programmes), 37.7% of the programmes stated that they discontinued psychological counselling during COVID-19 [12]. Combined with reductions in CR

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staffing, this indicates that screening for anxiety and depression during COVID-19 may likewise be affected, however, data on this is not presented in the mentioned study and knowledge of this therefore unknown [12].

Patient level barriers may also have influenced rates of screening for anxiety and depression in CR. Several studies have reported cardiac patients avoiding healthcare during the COVID-19 pandemic, as they feared getting infected [15–18]. Fewer cardiac patients attending the healthcare system may therefore also affect the number of relevant cardiac patients available for screening in CR.

Taken together, there is a knowledge gap regarding effective screening for anxiety and depression in CR in the post COVID era.

Regarding anxiety and depression, increases in levels are reported globally in the general population during COVID-19 [19], however, the full extent remains uncertain [20]. Limited literature exists on prevalence of anxiety and depression during and post the COVID-19 pandemic in cardiac populations. One study reported a 11.7% prevalence of anxiety and a 9.2% prevalance of depression, respectively, among Chinese cardiac outpatients [21]. Another study reported an incidence of anxiety of 51.7% and depression of 34.6%, respectively, among Pakistani patients with acute myocardial infarction [22]. This difference in cardiac populations may be attributed to e.g., differences in cardiac diagnosis, the patient pathway, or the contexts of the respective countries. Since these studies include relative small numbers of patients, a large scale study is lacking to better estimate the impact of COVID-19 on anxiety and depression among cardiac patients.

Thus, the aims of this study are twofold: (1) to investigate the extent of screening for anxiety and depression as part of CR during a period of significant service change; (2) to estimate the prevalence of anxiety and depression in patients attending CR during this period.

2. Methods

We used an observational study design based on a retrospective cohort, and the STROBE guidelines (Strengthening the Reporting of Observational Studies in Epidemiology) [23] for reporting of the results.

2.1. Data collection

The data were collected in routine CR in the United Kingdom (UK). The National Audit of Cardiac Rehabilitation (NACR) collects a wide range of patient and provider level data to assess and improve the quality of CR [24]. Data includes sociodemographic and clinical variables at the patient level, as well as service level variations at the provider level according to the standards of the British Association for Cardiac Prevention and Rehabilitation (BACPR) [25]. NHS England hosts the NACR, and the data are kept under NHS data requirements. NACR is permitted to use anonymized data for quality and service improvement purposes without separate ethical approval or individual informed consent.

2.2. Participants

The study population consisted of all patients entered in the NACR database and having an initial CR assessment in the period from 1st April 2018 to 31st March 2022 ($n = 245{,}705$).

2.3. Measures

2.3.1. Outcome measure

Screening for anxiety and depression is a core component of CR and should be utilized with a validated tool. NACR has the possibility to register data with respect to this through three validated patient-reported questionnaires: the Hospital Anxiety and Depression Scale (HADS) [26], the Generalized Anxiety Disorder (GAD-7) [27] and the Patient Health Questionnaire (PHQ-9) [28]. A composite binary outcome measure was made from these questionnaires, so scores from either both domains of the HADS or scores from both the GAD-7 and the PHQ-9 had to be reported for a patient to be categorized as screened for anxiety and depression.

2.3.2. Screening tools

The HADS consists of 14 items with seven items each covering the domains anxiety and depression. The HADS is broadly used within CR and is found reliable and valid for assessment of cardiac patients [1,29]. GAD-7 consists of seven items related to general anxiety, while PHQ-9 consists of nine items related to depression. The questionnaires are scored on a scale from 0 to 3, with higher scores indicating more symptoms. Hence, HADS and GAD-7 scores will be in a range from 0 to 21, while PHQ-9 scores will have a score range from 0 to 27.

2.3.3. Exposure measures

Variables selected for adjustment were chosen a priori based on the literature and expert opinions, since the literature on the topic was sparse. Regarding sociodemographic variables, age was used as a continuous variable, while gender was categorized as male or female. With respect to gender, this binary categorization was how data were collected and labelled at the clinical CR settings when reporting to NACR. Cohabitant status was categorized as single (single/widowed/separated) or partnered (married/partnered), and ethnic group as white or non-white. Index of multiple deprivation (IMD) is a measure that classifies the relative deprivation of a small area in England [30]. Seven domains of deprivation are weighted differently and aggregated into one single score. We categorized the IMD scores into quintiles. Regarding clinical variables, we categorized revascularization as being treated with either percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) versus not being revascularized. We also categorized patients as being tested for physical fitness with an objective physical fitness test or not (yes/no). Physical fitness tests consisted of valid measures from e.g., Incremental Shuttle Walking Test or 6-Minutes Walking Test. We used current smoking (yes/no), physical activity $<$150 min per week (yes/no), and BMI $\geq$ 30 (yes/no) as binary variables. Data on comorbidity was collected from patients' medical history, which was verified by CR clinicians. With respect to comorbidities, we used history of anxiety, history of depression, angina, arthritis, rheumatism, osteoporosis, chronic back problems, diabetes, hyperlipidaemia, stroke, and chronic obstructive pulmonary disease as binary variables (yes/no).

Regarding provider level data, we used these as an indicator for quality of CR service. We categorized the CR programs as certified or not, according to the National Certification Program for Cardiac Rehabilitation in the UK. To be categorized as certified, a program had to meet the seven key performance indicators decided by BACPR [8]. To assess changes over time we included year of participating in CR.

A sub-analysis within the 4-year study period related to Covid-19 impact on CR service delivery was defined as April 1st 2020 to March 31st 2021 (2020/2021).

2.4. Statistical analysis

We used descriptive statistics to outline baseline characteristics with means, standard deviations, and percentages. A comparison of baseline characteristics between groups of screened versus non-screened was conducted using Student's *t*-test for continuous variables and Chi^2-test for categorical variables. For analysis of associations between exposure measures and screening for anxiety and depression, we utilized a multivariate logistic regression model, applying odds-ratios. Since NACR contains a wide range of comorbidities ($n = 18$), we conducted a stepwise backward selection of these and chose beforehand to remove erectile dysfunction as it is a male only condition. Further six comorbidities were removed due to statistical insignificance (asthma, emphysema, cancer, claudication, hypertension, family history of

cardiac disease).

The impact of missing cases in the multivariate analysis was tested using a stepwise forward selection of groups of core variables (data not shown). Inclusion of variables did not alter the results in the first steps, while when including clinical variables, the variables age, BMI, and seven comorbidities became insignificant. Adding IMD and service level data did not further alter the results. We chose to keep age and BMI in the multivariate logistic regression model as previous studies have shown associations between screening and these two factors [3].

We investigated the prevalence of anxiety and depression using the common used clinically cut-off scores of HADS - where scores ≥8 indicates presence of anxiety/depression – and reported prevalence as numbers and percentages [29]. We analysed if prevalence of anxiety and depression were evenly spread across the included four years and the IMD, using numbers, percentages, and *p*-values in this stratification. We used only the HADS scores in the sub-analysis, as these scores represented the majority of the population and cut-off scores scoring as well as range differ from HADS in the other questionnaires (GAD-7 and PHQ-9).

Sensitivity analysis showed no difference in results when using CABG and PCI individually instead of merging them to one variable (revascularisation). Also, sensitivity analysis were performed to ensure that there was no systematic shift in the population in any of the included sociodemographic variables across the included four years.

The statistical analyses were conducted using STATA version 17 and a statistical level of <0.05 was applied to all analyses.

3. Results

3.1. Study population

The total study population comprised of 395,270 patients entered in the NACR database during a 4-year period (Fig. 1). Among these, 245,705 had an initial CR assessment and constituted the study population. We found that 52.4% of the study population were screened for anxiety and depression at start of CR, while the remaining 47.6% were not. Out of the screened patients, 89.8% (n = 115,578) were screened with HADS and 10.5% (n = 13,552) were screened with GAD-7 plus PHQ-9, while 0.3% (n = 487) were screened with both combinations.

3.2. Baseline characteristics

Table 1 describes characteristics of the study population, comparing screened with non-screened patients. The two groups were statistically significantly different on all baseline characteristics ($p < 0.001$ for all variables). Subgroups more likely to be screened were younger, male, partnered, of white ethnicity, living in the least deprived areas, treated with revascularization, tested for physical fitness, non-smoking, physically active>150 min per week, and having a BMI < 30.

With respect to comorbidities, we found that patients with history of anxiety, history of depression, angina pectoris, arthritis, rheumatism, osteoporosis, chronic back pain, and hyperlipidaemia were more likely to be screened, while patients with diabetes, stroke and chronic obstructive pulmonary disease were less likely to be screened. Patients attending CR in a certified CR program were more likely to be screened compared to patients attending CR in uncertified CR programs (60.2% versus 47.3%).

Regarding changes over time, patients participating in CR in the year April 2020–March 2021 were less likely to be screened compared with previous and following years, ranging from 38.5% to 62.5%.

3.3. Logistic regression model

Table 2 shows the adjusted odds-ratios (OR) with 95% confidence intervals (CI) for being screened for anxiety and depression, with the inclusion of 68,117 cases.

With respect to sociodemographic variables, we found that patients with female gender (OR 0.96; CI:0.92–0.99; $p = 0.039$), patients living alone (OR 0.94; CI:0.90–0.98; $p = 0.004$), and patients of non-white ethnicity (OR 0.95; CI:0.90–0.99; $p = 0.042$) were less likely to be screened. Patients living in the least deprived areas were more likely to be screened, compared to patients living in the most deprived areas (OR 1.28; CI:1.20–1.36; $p < 0.001$).

For the clinical variables, patients tested for physical fitness were more likely to be screened compared to untested patients (OR 2.55; CI:2.44–2.66; $p < 0.001$). We found that patients who were currently smoking (OR 0.70; CI:0.66–0.75; $p < 0.001$) and patients who were physically active<150 min per week (OR 0.58; CI:0.55–0.60; $p < 0.001$) were less likely to be screened.

Patients with history of anxiety and depression, respectively, were more likely to be screened (OR 1.24; CI:1.15–1.34; $p < 0.001$) (OR 1.08;

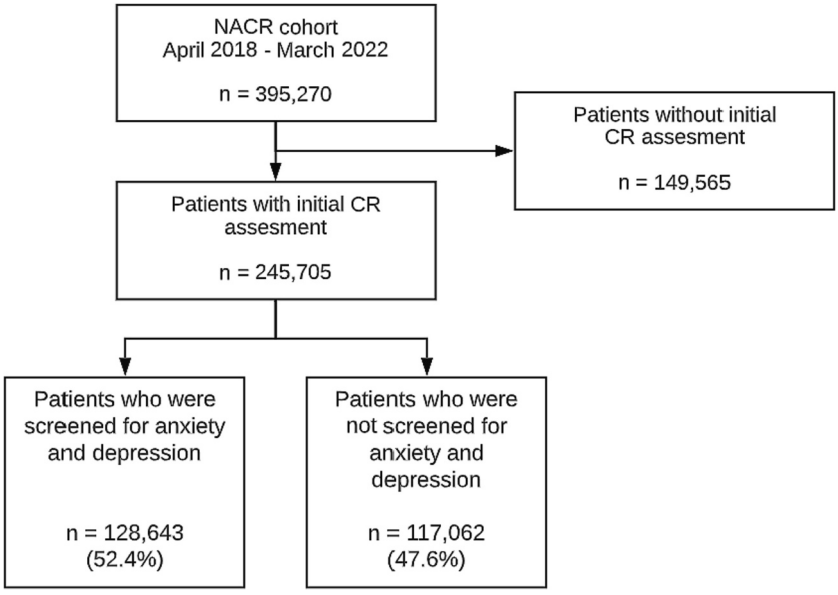

Fig. 1. Flowchart of the study population.

Table 1
Baseline characteristics of patients with initial assessment in cardiac rehabilitation, stratified by screening for anxiety and depression (*p-value between non-screened vs. screened).

	Total	Non-screened	Screened	p-value*
Socio-demographics n (%)				
Age: mean (SD), range (n = 245,705)	65.8 (12.1), 18–118	66.1 (12.5), 18–118	65.6 (11.6), 18–102	<0.001
Gender (*n* = 241,736)				<0.001
Female	67,242 (27.8)	33,107 (49.2)	34,135 (50.8)	
Male	174,494 (72.2)	80,702 (46.2)	93,792 (53.8)	
Cohabitant status (*n* = 162,146)				<0.001
Single	40,326 (24.9)	17,732 (44.0)	22,594 (56.0)	
Partnered	121,820 (75.1)	49,843 (40.9)	71,977 (59.1)	
Ethnic group (*n* = 203,904)				<0.001
Non-White	37,164 (18.2)	18.479 (49.7)	18,685 (50.3)	
White	166,740 (81.8)	73,788 (44.2)	92,952 (55.8)	
Index of Multiple Deprivation (*n* = 215,067)				<0.001
Lowest quintile	39,314 (18.3)	22,137 (56.3)	17,177 (43.7)	
Second quintile	41,418 (19.3)	21,382 (51.6)	20,037 (48.4)	
Third quintile	44,162 (20.5)	21,041 (47.6)	23,121 (52.4)	
Fourth quintile	45,282 (21.0)	20,410 (45.1)	24,872 (54.9)	
Highest quintile	44,890 (20.9)	19,060 (42.5)	25.830 (57.5)	
Clinical data n (%)				
Revascularisation procedure (n = 245,705)				<0.001
Yes	153,894 (62.6)	70,256 (45.7)	83,638 (54.3)	
No	91,811 (37.4)	46,806 (51.0)	45,005 (49.0)	
Tested for objective physical fitness				<0.001
Yes	78,210 (31.8)	21,927 (28.0)	56,283 (72.0)	
No	167,495 (68.2)	95,135 (56.8)	72.360 (43.2)	
Smoking at start of CR (*n* = 209,945)				<0.001
Yes	20,541 (9.8)	10.920 (53.2)	9621 (46.8)	
No	189,404 (90.2)	76,365 (40.3)	113,039 (59.3)	
Physical activity<150 min/week (*n* = 156,399)				<0.001
Yes	90,589 (57.9)	33,221 (36.7)	57,368 (63.3)	
No	65,810 (42,1)	14,474 (22.0)	51,336 (78.0)	
Body mass index ≥*30* (*n* = 187,660)				<0.001
Yes	61,222 (32.6)	23,981 (39.2)	37,241 (60.8)	
No	126,438 (67.4)	47,505 (37.6)	78,933 (62.4)	
Comorbidities n (%) (*n* = 189,294)				
History of anxiety				<0.001
Yes	14,002 (7.4)	5.016 (35.8)	8986 (64.2)	
No	175,292 (92.6)	79,991 (45.6)	95,301 (54.4)	
History of depression				<0.001
Yes	15,232 (8.1)	5937 (39.0)	9295 (61.0)	
No	174,062 (91.9)	79,070 (45.4)	94,992 (54.8)	
Angina pectoris				<0.001
Yes	25,381 (13.4)	10,161 (40.0)	15,220 (60.0)	
No	163,913 (86.6)	74,846 (45.7)	89,067 (54.3)	
Arthritis				<0.001
Yes	26,951 (14.2)	10,353 (38.4)	16,598 (61.6)	
No	162,343 (85.8)	74,654 (46.0)	87,689 (54.0)	
Rheumatism				<0.001
Yes	4152 (2.2)	1492 (35.9)	2659 (64.1)	
No	185,143 (97.8)	83,515 (45.1)	101,628 (54.9)	
Osteoporosis				<0.001
Yes	3438 (1.8)	1200 (34.9)	2238 (65.1)	
No	185,856 (98.2)	83,808 (45.1)	102,049 (54.9)	
Chronic back pain				<0.001
Yes	16,421 (8.7)	4434 (27.0)	11,987 (73.0)	
No	172,873 (91.3)	80,573 (46.6)	92,300 (53.4)	
Hyperlipidaemia				<0.001
Yes	61,786 (32.6)	27,376 (44.3)	34,410 (55.7)	
No	127,508 (67.4)	57,631 (45.2)	69,877 (54.8)	
Diabetes				<0.001
Yes	45,748 (24.2)	22,136 (48.4)	23,612 (51.6)	
No	143,546 (75.8)	62,871 (43.8)	80,675 (56.2)	
Stroke				<0.001
Yes	9938 (5.3)	4709 (47.4)	5229 (52.6)	
No	179,356 (94.7)	80,298 (44.8)	99,058 (55.2)	
Chronic obstructive pulmonary disease				<0.001
Yes	7457 (3.9)	3782 (50.7)	3675 (49.3)	
No	181,837 (96.1)	81,225 (44.7)	100,612 (55.3)	
Provider level data n (%) (n = 245,705)				
CR Certification				<0.001
Yes	96,732 (39.4)	38,475 (39.8)	58,257 (60.2)	
No	148,973 (60.6)	78,587 (52.7)	370,386 (47.3)	
Year of CR				<0.001
2018/2019	70.237 (28.6)	26,356 (37.5)	43.881 (62.5)	
2019/2020	68,614 (27.9)	29,105 (42.4)	39,509 (57.6)	
2020/2021	55,130 (22.4)	33,906 (61.6)	21,244 (38.5)	
2021/2022	51.724 (21.1)	27,695 (53.5)	24,029 (46.5)	

Abbreviations: SD: standard deviation, CR: cardiac rehabilitation.

Table 2
Multiple adjusted odds-ratios for screening for anxiety and depression (n = 68,117).

Variables	Odds ratio	95% CI	p-value
Socio-demographic			
Age (continuous)	1.00	0.99–1.00	0.929
Female gender (yes)	0.96	0.92–0.99	**0.039**
Living alone (yes)	0.94	0.90–0.98	**0.004**
Ethnic group: Non-white (yes)	0.95	0.90–0.99	**0.042**
Index of Multiple Deprivation: *Lowest quintile*	Reference		
Second quintile	1.26	1.19–1.35	**<0.001**
Third quintile	1.21	1.14–1.29	**<0.001**
Fourth quintile	1.20	1.13–1.28	**<0.001**
Highest quintile	1.28	1.20–1.36	**<0.001**
Clinical			
Revascularization (yes)	1.07	1.03–1.11	**0.001**
Tested for objective physical fitness (yes)	2.55	2.44–2.66	**<0.001**
Current smoking (yes)	0.70	0.66–0.75	**<0.001**
Physical activity<150 min/week (yes)	0.58	0.55–0.60	**<0.001**
BMI ≥ 30 (yes)	0.99	0.95–1.03	0.590
Comorbidity			
History of anxiety (yes)	1.24	1.15–1.34	**<0.001**
History of depression (yes)	1.08	1.00–1.17	**0.040**
Angina pectoris (yes)	1.10	1.04–1.16	**0.001**
Arthritis (yes)	1.11	1.05–1.17	**<0.001**
Rheumatism (yes)	1.24	1.09–1.41	**0.001**
Osteoporosis (yes)	1.24	1.07–1.43	**0.003**
Chronic back pain (yes)	1.70	1.59–1.81	**<0.001**
Diabetes (yes)	0.92	0.88–0.96	**<0.001**
Hyperlipidemia (yes)	0.87	0.83–0.90	**<0.001**
Stroke (yes)	0.91	0.81–0.99	**0.025**
Chronic obstructive pulmonary disease (yes)	0.90	0.81–0.99	**0.024**
Provider level			
Certified CR center (yes)	1.48	1.42–1.54	**<0.001**
Year of CR: *2018/2019*	2.50	2.37–2.84	**<0.001**
2019/2020	2.02	1.92–2.12	**<0.001**
2020/2021	Reference		
2021/2022	1.45	1.37–1.53	**<0.001**

Abbreviations: CI: confidence interval; CR: cardiac rehabilitation

CI1.00–1.17; $p = 0.40$).

We found that certified CR centres were more likely to screen for anxiety and depression compared to uncertified CR centres (OR 1.48; CI:1.42–1.54; $p < 0.001$).

When analysing changes in screening practice over time, we found that compared to years 2020/2021 patients were more likely to be screened in the previous years (OR 2.50; CI:2.37–2.84; p < 0.001 and OR 2.02; CI:1.92–2.12; p < 0.001) and the following year (OR 1.45; 1.37–1.53; p < 0.001).

3.4. Prevalence of anxiety and depression and stratified by year and IMD

We found a prevalence of 31% ($n = 35,689$) for anxiety and a prevalence of 23% ($n = 26,238$) for depression in the study population, as measured with the HADS.

When stratifying by year of CR (Table 3), there was a statistically significant difference in prevalence of both anxiety and depression ($p < 0.001$). The prevalence of anxiety dropped from 34.4% in years 2018/2019 to 15.8% in 2020/2021 and rose to 18.6% in 2021/2022. Likewise, the prevalence of depression dropped from 33.5% in years 2018/2019 to 16.5% in 2020/2021 and rose to 19.2% in 2021/2022.

We also found a statistically significant differences in prevalence of both anxiety and depression across the IMD ($p < 0.001$). The stratification showed an incremental increase in prevalence of anxiety, ranging from 18.4% in the least deprived areas to 21.2% in the most deprived areas. Similarly, for depression, an incremental increase ranged from 17.4% in the least deprived areas to 22.4% in the most deprived areas (Data in Supplemental File A).

Table 3
Prevalence of anxiety and depression, measured by the Hospital Anxiety and Depression Scale (HADS) and stratified by year of cardiac rehabilitation.

HADS Scores	HADS-Anxiety (n = 115,733)	HADS-Depression (n = 115,747)
Mean (SD), range	5.7 (4.4), 0–21	4.8 (3.9), 0–21
Normal (0–7) n (%)	80,044 (69.2%)	89,507 (77.3%)
Clinically relevant anxiety and depression scores (8–21) n (%)	35,689 (30.8%)	26,238 (22.7%)

Proportion of patients with clinically relevant anxiety and depression scores, stratified by year

Year	HADS-Anxiety (n = 35,689) p < 0.001	HADS-Depression (n = 26,238) p < 0.001
2018/2019	12,280 (34.4%)	8794 (33.5%)
2019/2020	11.146 (31.2%)	8086 (30.8%)
2020/2021	5629 (15.8%)	4322 (16.5%)
2021/2022	6634 (18.6%)	5036 (19.2%)

4. Discussion

This observational study showed that COVID-19 negatively impacted screening for anxiety and depression in CR, with patients attending CR both previous years as well as the following year having higher odds for being screened. The study also found a decrease in prevalence of anxiety and depression during COVID-19, with anxiety dropping from 34.4% to 15.8% ($p < 0.001$) and depression dropping from 33.5% to 16.5% ($p < 0.001$), respectively.

4.1. Impact of COVID-19 on screening for anxiety and depression

To our knowledge, this is the first study to investigate the impact of COVID-19 on screening for anxiety and depression in CR. Given the reported severe impact on CR delivery globally [12], it was expected that COVID-19 would also impact the screening process; however, the magnitude was unknown. On one hand one can argue that in times of a life-threatening pandemic, assessment of mental health in CR is a component to deprioritize. On the other hand, as anxiety and depression are associated with increased morbidity and mortality [1], we do not know the long-term consequences of refraining from assessment of mental health. In combination with cessation or reduction in other CR components, this could potentially mean increased cardiac morbidity and mortality in the following years [12].

The odds for screening were greatly increased in patients tested for objective physical fitness (OR 2.55; CI 2.44–2.66; $p < 0.001$). Although we cannot draw causation due to the nature of observational data, we interpret this as bringing patients onsite for an in-person contact may enhance the likelihood for screening. Barriers for screening by phone or digital solutions may be lack of time or lack of resources for development of feasible secure digital solutions, or also simply issues with lack of reimbursement [31]. The European Association of Preventive Cardiology encourages cardiac telerehabilitation [32], and incorporating a digital solution for collecting patient-reported outcomes on mental health in telerehabilitation may elevate screening rates, as home-based or remote models for CR are on the rise [33]. Opposing this, health professionals have raised concern about remote delivery of psychological care, as it reduces the capability to interpret patients' psychological well-being [34,35]. However, models for evidence-based online treatment of anxiety and depression are also on the rise [36,37], potentially leading to available low-cost solutions for psychological treatment of cardiac patients.

BACPR certified CR centers were more likely to screen for anxiety

and depression compared to uncertified centers (OR 1.48; CI 1.42–1.54; $p < 0.001$), which is previously reported [3]. Since screening is not a key performance indicator of the BACPR certification [8], we can speculate if the certification process may also push other areas of CR in a positive direction.

As previously shown, current smoking (OR 0.70; CI 0.66–0.75; $p < 0.001$) and physical activity<150 min per week (OR 0.58; CI 0.55–0.60; $p < 0.001$) were negatively associated with screening practice [3]. Living in the least deprived areas was positively associated with being screened (OR 1.28; CI 1.42–1.54; $p < 0.001$). Factors like smoking, physical inactivity and living in the most deprived areas are at the same time associated with increased risk for anxiety and depression in cardiac patients [14,38,39]. In addition, our results showed a higher prevalence of anxiety and depression in the most deprived areas. Taken together, this means that vulnerable high-risk patients were less likely to be identified and offered psychological treatment, leading to inequity in the delivery of CR services. Therefore, we recommend action from both decision-makers and clinical staff, to ensure resources and prioritization of handling mental health in CR – especially for high-risk patients.

4.2. Prevalence of anxiety and depression during COVID-19

As mentioned earlier, this study revealed a decrease in the prevalence of anxiety and depression during COVID-19, given the reported increase in the general population globally [19]. We can only speculate if this paradox can be caused from greater avoidance of the health care system during COVID-19, among CR patients with anxiety and depression. Reflecting on our findings, a study found a prevalence of 11.7% for anxiety and 9.2% for depression in a cardiac population post-COVID-19 [21], which are also below the expected rates ranging from 20 to 30% [1].

Studies have reported on cardiac patients' avoidance of the health care system during COVID-19, due to fear of getting infected. For instance, one study found that 31% of patients with ST-elevated myocardial infarction were delayed>12 h, and out of these 27% avoided the hospital due to fear of infection with COVID-19 [18], indicating that despite severe cardiac symptoms patients chose to stay at home out of worry. Another study showed that despite cardiac symptoms, 9.1% of the cardiac patients avoided seeing their general practitioner out of concern from getting infected, and that this avoidance was associated with anxiety [15]. A third study among patients with chronic conditions – including cardiac disease – found that anxiety and depression were associated with greater avoidance of routine medical visits [16]. This could possibly be a contributing factor by which to explain our results, suggesting that a high porportion of patients with anxiety and depression may have refrained from attending CR due to fear of infection. These assumptions indicate that health care providers should enhance screening, attention to and delivery of psychological care in times of pandemics, to ensure especially high-risk patients of evidence-based CR.

4.3. Strengths and limitations

Strengths of this study include the high volume of data collected in routine care across >200 CR settings, thus reflecting real world data to a large extent. Limitations include only using UK data, since national health authorities may have handled COVID-19 differently in other countries, and thereby reducing external generalisability. In addition, we do not have data on patients COVID-19 status, which could potentially have an impact on the results. Another important limitation is that reasons for not screening are not collected in NACR, and further research is therefore needed to illuminate barriers for screening.

4.4. Conclusion

This study showed that CR service provision was negatively impacted during COVID-19 leading to much lower screening for anxiety and depression in the CR setting. These findings highlight a need for safeguarding of assessment of psychological health during times of significant service change. The study also showed a decrease in the prevalence of anxiety and depression among patients attending CR during COVID-19. Given the increased prevalence of anxiety and depression in the general population in this period, this indicates that psychologically affected cardiac patients refrained from attending CR out of fear from getting infected. This calls for development of new digital solutions for delivery of CR, such as telerehabilitation [40].

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Declaration of Competing Interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijcard.2023.131379.

References

[1] N. Pogosova, H. Saner, S.S. Pedersen, M.E. Cupples, H. McGee, S. Höfer, F. Doyle, J. P. Schmid, R. von Känel, Cardiac Rehabilitation Section of the European Association of Cardiovascular Prevention and Rehabilitation of the European Society of Cardiology, Psychosocial aspects in cardiac rehabilitation: from theory to practice. A position paper from the cardiac rehabilitation section of the European association of cardiovascular prevention and rehabilitation of the european society of cardiology, Eur. J. Prev. Cardiol. 22 (10) (2015) 1290–1306, https://doi.org/10.1177/2047487314543075.

[2] N. Pogosova, K. Kotseva, D. De Bacquer, R. von Känel, D. De Smedt, J. Bruthans, M. Dolzhenko, EUROASPIRE Investigators, Psychosocial risk factors in relation to other cardiovascular risk factors in coronary heart disease: results from the EUROASPIRE IV survey. A registry from the european society of cardiology, Eur. J. Prev. Cardiol. 24 (13) (2017) 1371–1380, https://doi.org/10.1177/2047487317711334.

[3] C. Helmark, A. Harrison, S.S. Pedersen, P. Doherty, Systematic screening for anxiety and depression in cardiac rehabilitation - are we there yet? Int. J. Cardiol. 352 (2022) 65–71, https://doi.org/10.1016/j.ijcard.2022.02.004.

[4] N. Szpakowski, F. Qiu, S. Masih, P. Kurdyak, H.C. Wijeysundera, Economic impact of subsequent depression in patients with a new diagnosis of stable angina: a population-based study, J. Am. Heart Assoc. 6 (10) (2017), e006911, https://doi.org/10.1161/JAHA.117.006911.

[5] G.N. Levine, B.E. Cohen, Y. Commodore-Mensah, J. Fleury, J.C. Huffman, U. Khalid, D.R. Labarthe, H. Lavretsky, E.D. Michos, E.S. Spatz, L.D. Kubzansky, Psychological health, well-being, and the mind-heart-body connection: a scientific statement from the American Heart Association, Circulation 143 (10) (2021) e763–e783, https://doi.org/10.1161/CIR.0000000000000947.

[6] R.F.E. Pedretti, D. Hansen, M. Ambrosetti, M. Back, T. Berger, M.C. Ferreira, V. Cornelissen, C.H. Davos, W. Doehner, C. de Pablo Y Zarzosa, I. Frederix, A. Greco, D. Kurpas, M. Michal, E. Osto, S.S. Pedersen, R.E. Salvador, M. Simonenko, P. Steca, D.R. Thompson, A. Abreu, How to optimize the adherence to a guideline-directed medical therapy in the secondary prevention of cardiovascular diseases: a clinical consensus statement from the European Association of Preventive Cardiology, Eur. J. Prev. Cardiol. 30 (2) (2023) 149–166, https://doi.org/10.1093/eurjpc/zwac204.

[7] M. Ambrosetti, A. Abreu, U. Corrà, C.H. Davos, D. Hansen, I. Frederix, M.C. Iliou, R.F.E. Pedretti, J.P. Schmid, C. Vigorito, H. Voller, M. Wilhelm, M.F. Piepoli, B. Bjarnason-Wehrens, T. Berger, A. Cohen-Solal, V. Cornelissen, P. Dendale, W. Doehner, D. Gaita, A.O. Zwisler, Secondary prevention through comprehensive cardiovascular rehabilitation: from knowledge to implementation. 2020 update. A position paper from the secondary prevention and rehabilitation section of the European Association of Preventive Cardiology, Eur. J. Prev. Cardiol. 28 (5) (2021) 460–495, https://doi.org/10.1177/2047487320913379.

[8] BACPR, Cardiovascular disease prevention and rehabilitation 2017, Br. Assoc. Cardiovasc. Prev. Rehabil. (2017) 1–26.

[9] M.C. Cahill, A. Bilanovic, S. Kelly, S. Bacon, S.L. Grace, Screening for depression in cardiac rehabilitation: A REVIEW, J. Cardiopulm. Rehabil. Prev. 35 (4) (2015) 225–230, https://doi.org/10.1097/HCR.0000000000000101.

[10] M. Kruse, M. Laudicella, K.R. Olsen, A.D.O. Zwisler, C. Helmark, S.S. Pedersen, Effects of screening for anxiety and depression in patients with ischaemic heart disease - a nationwide Danish register study, Scand. J. Public Health 51 (2) (2023) 149–156.
[11] D.L. Hare, A.G.O. Stewart, A. Driscoll, S. Mathews, S.R. Toukhsati, Screening, referral and treatment of depression by Australian cardiologists, Heart Lung. Circ. 29 (3) (2020) 401–404, https://doi.org/10.1016/j.hlc.2019.03.009.
[12] G.L.M. Ghisi, Z. Xu, X. Liu, A. Mola, R. Gallagher, A.S. Babu, C. Yeung, S. Marzolini, J. Buckley, P. Oh, A. Contractor, S.L. Grace, Impacts of the COVID-19 pandemic on cardiac rehabilitation delivery around the world, Glob. Heart 16 (1) (2021) 43, https://doi.org/10.5334/gh.939.
[13] S. Marzolini, G.L.M. Ghisi, A.A. Hébert, S. Ahden, P. Oh, Cardiac rehabilitation in Canada during COVID-19, CJC Open 3 (2) (2021) 152–158, https://doi.org/10.1016/j.cjco.2020.09.021.
[14] S. Sever, A.S. Harrison, P. Doherty, Levels of depressive symptoms in cardiac patients attending cardiac rehabilitation with a history of depression: pre Covid-19 and Covid-19 period comparison, BMC Cardiovasc. Disord. 22 (1) (2022) 427, https://doi.org/10.1186/s12872-022-02867-4.
[15] N. Maehl, M. Bleckwenn, S.G. Riedel-Heller, S. Mehlhorn, S. Lippmann, T. Deutsch, A. Schrimpf, The impact of the COVID-19 pandemic on avoidance of health care, symptom severity, and mental well-being in patients with coronary artery disease, Front. Med. 8 (2021) 760265, https://doi.org/10.3389/fmed.2021.760265.
[16] R.M. Lovett, L. Opsasnick, A. Russell, E. Yoon, S. Weiner-Light, M. Serper, S. Cooper Bailey, M.S. Wolf, Prevalence of anxiety and depressive symptoms and impact on self-management among adults with chronic conditions in Chicago, Illinois, USA, during the COVID-19 pandemic: a cross-sectional survey, BMJ Open 12 (1) (2022), e052495, https://doi.org/10.1136/bmjopen-2021-052495.
[17] F. D'Ascenzi, M. Cameli, S. Forni, F. Gemmi, C. Szasz, V.D. Fabrizio, M.T. Mechi, M. Nocci, S. Mondillo, S. Valente, Reduction of emergency calls and hospitalizations for cardiac causes: effects of Covid-19 pandemic and lockdown in Tuscany region, Front. Cardiovasc. Med. 8 (2021) 625569, https://doi.org/10.3389/fcvm.2021.625569.
[18] T.A. Hammad, M. Parikh, N. Tashtish, C.M. Lowry, D. Gorbey, F. Forouzandeh, S. J. Filby, W.M. Wolf, M.A. Costa, D.I. Simon, M.H. Shishehbor, Impact of COVID-19 pandemic on ST-elevation myocardial infarction in a non-COVID-19 epicenter, Catheteriz. Cardiovasc. Intervent. 97 (2) (2021) 208–214, https://doi.org/10.1002/ccd.28997.
[19] COVID-19 Mental Disorders Collaborators, Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic, Lancet (London, England) 398 (10312) (2021) 1700–1712, https://doi.org/10.1016/S0140-6736(21)02143-7.
[20] M. Daly, E. Robinson, Depression and anxiety during COVID-19, Lancet (London, England) 399 (10324) (2022) 518, https://doi.org/10.1016/S0140-6736(22)00187-8.
[21] M. Wu, L. Shen, Q. Wang, L. Liu, S. Lu, J. Jin, Z. Dai, Z. Shu, Anxiety and depression prevalence and risk factors among patients with cardiovascular diseases in post-COVID-19 China, Front. Public Health 9 (2022) 758874, https://doi.org/10.3389/fpubh.2021.758874.
[22] S. Dastgeer, A. Saad, S. Fatima, I. Javaid, K. Rehman, R. Amin, Incidence of depression and anxiety among patients with acute myocardial infarction during COVID-19 pandemic, Pakistan J. Neurol. Surg (2020), https://doi.org/10.36552/PJNS.V24I4.473.
[23] E. von Elm, D.G. Altman, M. Egger, S.J. Pocock, P.C. Gøtzsche, J. P. Vandenbroucke, STROBE Initiative, The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies, Int. J. Surgery (London, England) 12 (12) (2014) 1495–1499, https://doi.org/10.1016/j.ijsu.2014.07.013.
[24] National Audit of Cardiac Rehabilitation (NACR) Report, British Heart Foundation, 2020 [Online]. Available: https://www.bhf.org.uk/informationsupport/publications/statistics/national-audit-of-cardiac-rehabilitation-quality-and-outcomes-report-2020. [Accessed: 08-Dec-2022].
[25] A. Cowie, J. Buckley, P. Doherty, G. Furze, J. Hayward, S. Hinton, J. Jones, L. Speck, H. Dalal, J. Mills, British Association for Cardiovascular Prevention and Rehabilitation (BACPR), Standards and core components for cardiovascular disease prevention and rehabilitation, Heart 105 (7) (2019) 510–515, https://doi.org/10.1136/heartjnl-2018-314206.
[26] A.S. Zigmond, R.P. Snaith, The hospital anxiety and depression scale, Acta Psychiatr. Scand. 67 (6) (1983) 361–370, https://doi.org/10.1111/j.1600-0447.1983.tb09716.x.
[27] R.L. Spitzer, K. Kroenke, J.B. Williams, B. Löwe, A brief measure for assessing generalized anxiety disorder: the GAD-7, Arch. Intern. Med. 166 (10) (2006) 1092–1097, https://doi.org/10.1001/archinte.166.10.1092.
[28] K. Kroenke, R.L. Spitzer, J.B. Williams, The PHQ-9: validity of a brief depression severity measure, J. Gen. Intern. Med. 16 (9) (2001) 606–613, https://doi.org/10.1046/j.1525-1497.2001.016009606.x.
[29] I. Bjelland, A.A. Dahl, T.T. Haug, D. Neckelmann, The validity of the hospital anxiety and depression scale. An updated literature review, J. Psychosom. Res. 52 (2) (2002) 69–77, https://doi.org/10.1016/s0022-3999(01)00296-3.
[30] G.A. Abel, M.E. Barclay, R.A. Payne, Adjusted indices of multiple deprivation to enable comparisons within and between constituent countries of the UK including an illustration using mortality rates, BMJ Open 6 (11) (2016), e012750, https://doi.org/10.1136/bmjopen-2016-012750.
[31] I. Frederix, E.G. Caiani, P. Dendale, S. Anker, J. Bax, A. Böhm, M. Cowie, J. Crawford, N. de Groot, P. Dilaveris, T. Hansen, F. Koehler, G. Krstačić, E. Lambrinou, P. Lancellotti, P. Meier, L. Neubeck, G. Parati, E. Piotrowicz, M. Tubaro, E. van der Velde, ESC e-Cardiology Working Group Position Paper: overcoming challenges in digital health implementation in cardiovascular medicine, Eur. J. Prev. Cardiol. 26 (11) (2019) 1166–1177, https://doi.org/10.1177/2047487319832394.
[32] M. Scherrenberg, M. Wilhelm, D. Hansen, H. Völler, V. Cornelissen, I. Frederix, H. Kemps, P. Dendale, The future is now: a call for action for cardiac telerehabilitation in the COVID-19 pandemic from the secondary prevention and rehabilitation section of the European Association of Preventive Cardiology, Eur. J. Prev. Cardiol. 28 (5) (2021) 524–540, https://doi.org/10.1177/2047487320939671.
[33] National Audit of Cardiac Rehabilitation (NACR) Report, British Heart Foundation, 2021 [Online]. Available: https://www.bhf.org.uk/informationsupport/publications/statistics/national-audit-of-cardiac-rehabilitation-quality-and-outcomes-report-2021. [Accessed: 16-Feb-2022].
[34] C. Helmark, C. Egholm, N. Rottmann, S.J. Skovbakke, C.M. Andersen, J. B. Johansen, J.C. Nielsen, C. Larroudé, S. Riahi, C.J. Brandt, S.S. Pedersen, A web-based intervention for patients with an implantable cardioverter defibrillator – A qualitative study of nurses' experiences (data from the ACQUIRE-ICD study), PEC Innovat. (2023), https://doi.org/10.1016/j.pecinn.2022.100110.
[35] S. Cartledge, J.C. Rawstorn, M. Tran, P. Ryan, E.J. Howden, A. Jackson, Telehealth is here to stay but not without challenges: a consultation of cardiac rehabilitation clinicians during COVID-19 in Victoria, Australia, Eur. J. Cardiovasc. Nurs. 21 (6) (2022) 548–558, https://doi.org/10.1093/eurjcn/zvab118.
[36] C. Helmark, R. Ahm, C.M. Andersen, S.J. Skovbakke, R. Kok, U.K. Wiil, T. Schmidt, J. Hjelmborg, L. Frostholm, D.H. Frydendal, T.B. Hansen, A.D. Zwisler, S. S. Pedersen, Internet-based treatment of anxiety and depression in patients with ischaemic heart disease attending cardiac rehabilitation: a feasibility study (eMindYourHeart). European heart journal, Digital Health 2 (2) (2021) 323–335, https://doi.org/10.1093/ehjdh/ztab037.
[37] S.S. Pedersen, S.J. Skovbakke, O. Skov, P. Carlbring, M.M. Burg, M. Habibović, R. Ahm, Internet-delivered, therapist-assisted treatment for anxiety and depression in patients with cardiovascular disease: evidence-base and challenges, Curr. Cardiol. Rep. (2023), https://doi.org/10.1007/s11886-023-01867-w. Advance online publication.
[38] S. Sever, S. Golder, P. Doherty, Factors associated with acute depressive symptoms in patients with comorbid depression attending cardiac rehabilitation, BMC Cardiovasc. Disord. 18 (1) (2018) 230, https://doi.org/10.1186/s12872-018-0974-2.
[39] B. Murphy, M. Le Grande, M. Alvarenga, M. Worcester, A. Jackson, Anxiety and depression after a cardiac event: prevalence and predictors, Front. Psychol. 10 (2020) 3010, https://doi.org/10.3389/fpsyg.2019.03010.
[40] N. Subedi, J.C. Rawstorn, L. Gao, H. Koorts, R. Maddison, Implementation of telerehabilitation interventions for the self-management of cardiovascular disease: systematic review, JMIR Mhealth Uhealth 8 (11) (2020), e17957, https://doi.org/10.2196/17957.